CLAIMS

What is claimed is:

1   1.   A machine readable medium having stored thereon:

2   a function requiring a set of one or more input parameters;

3   a first object including,

4   a first structure storing a key for each of said set of input parameters, and

5   an action method, which when applied by a processor, causes that processor to

6   invoke an action unit; and

7   a second object including,

8   a first structure to store data for identifying, for each of said set of input

9   parameters, the corresponding key and a value for that input parameter,

10   a second structure identifying said first object, and

11   an execute method, which when applied by a processor, causes that processor to

12   apply said action method.

13   said action unit including instructions, which when executed by a processor, cause that

14   processor to,

15   access said values, and

16   invoke said function using said values as input parameters.

1   2.   The machine readable medium of claim 1, wherein said function is contained within said

2   action unit.

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1   3.   The machine readable medium of claim 1, wherein said first structure in said second

2   object has stored therein, for at least one of said set of input parameters, the corresponding key

3   and a value for that input parameter.

1   4.   The machine readable medium of claim 1, wherein:

2   the data in said first structure of said second object identifies a third object; and

3   said third object includes a structure to store, for one or more of said set of input

4   parameters, the corresponding key and value for that input parameter.

1   5.   The machine readable medium of claim 1, wherein:

2   the data in said first structure of said second object identifies a third object; and

3   said third object includes,

4   a first structure to store a plurality of context objects, each of said plurality of

5   context objects to store, for one or more of said set of input parameters,

6   the corresponding key and a value for that input parameter, and

7   a second structure to store data identifying one of said plurality of context objects

8   as a default context object.

1   6.   The machine readable medium of claim 1, wherein:

2   said function provides a set of one or more output parameters;

3   said first structure in said first object also storing a key for each of said set of output

4   parameters.

1   7.   A machine readable medium having stored thereon:

2   a function requiring a set of one or more input parameters;

3   a first object including,

4   a first structure storing a key for each of said set of input parameters, and

5   an action method, which when applied by a processor, causes that processor to

6   invoke said function; and

7   a second object including,

8   a first structure identifying a third object,

9   a second structure identifying said first object, and

10   an execute method, which when applied by a processor, causes that processor to

11   apply said action method; and

12   said third object including,

13   a first structure to store a plurality of context objects, each of said plurality of

14   context objects to store, for one or more of said set of input parameters,

15   the corresponding key and a value for that input parameter, and

16   a second structure to store data identifying one of said plurality of context objects

17   as a default context object.

1   8.   The machine readable medium of claim 7 further having stored thereon:

2   an action unit including said function as a method.

1   9.   The machine readable medium of claim 7 further having stored thereon:

2   an action unit including instructions, which when executed by a processor, cause that

3   processor to invoke said function; and

4   wherein said action method, when applied, causes the execution of the instructions in said

5   action unit.

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1   10.   The machine readable medium of claim 7 further having stored thereon:

2   an action unit including instructions, which when executed by a processor, cause that

3   processor to,

4   access values for one or more of said set of input parameters from a selected one

5   of said plurality of context objects that is passed to said action unit, and

6   invoke said function using said values as input parameters; and

7   wherein said action method, when applied, causes said function to be invoked through the

8   instructions in said action unit.

1   11.   The machine readable medium of claim 10, wherein:

2   said second object also includes a first structure storing data identifying, for one or more

3   of said set of input parameters, the corresponding key and a value for that input

4   parameter; and

5   said instructions of said action unit, when executed by a processor, also cause that

6   processor to access values for one or more of said set of input parameters from

7   said first structure.

1   12.   The machine readable medium of claim 11, wherein:

2   said instructions of said action unit, when executed by a processor, also cause that

3   processor to access values for one or more of said set of input parameters from

4   said default context object.

1   13.   The machine readable medium of claim 11, wherein:

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2 said instructions of said action unit, when executed by a processor, also cause that

3   processor to access values for one or more of said set of input parameters from

4   said default context object.

1 14. The machine readable medium of claim 7 further having stored thereon:

2 said second object also includes a first structure to store data identifying, for one or more

3   of said set of input parameters, the corresponding key and a value for that input

4   parameter; and

5 an action unit including instructions, which when executed by a processor, cause that

6   processor to,

7   access values for said set of input parameters from said first structure of said

8   second object, a selected one of said plurality of context objects that is

9   passed to said action unit, and said default context object, and

10   invoke said function using said values as input parameters.

1 15. A machine readable medium having stored thereon:

2 a plurality of functions for one or more applications, each of said plurality of functions

3   requiring one or more input parameters, the input parameters required by said

4   plurality of functions collectively defining a set of parameter kinds irrespective of

5   data type, each parameter kind in said set being assigned a unique key;

6 a metadata object corresponding to each of said plurality of functions, each said metadata

7   object storing data to locate the corresponding one of said plurality of functions,

8   each said metadata object also storing the unique key for each input parameter

9   required by the corresponding one of said plurality of functions; and

10　　　each metadata object having one or more corresponding execution objects, each

11　　　　　execution object including a structure storing data to identify a value for each

12　　　　　input parameter of the one of said plurality of functions identified by the

13　　　　　corresponding metadata object.

1　16.　The machine readable medium of claim 15, wherein each parameter of said plurality of

2　functions is of one of a plurality of data types each supporting a range of values, wherein

3　different data is categorized irrespective of data type, and wherein each category of data defines

4　one of the parameter kinds.

1　17.　The machine readable medium of claim 15 further having stored thereon:

2　　an action unit for each of said plurality of functions, each of said action units including

3　　　　instructions, which when executed by a processor, cause that processor to invoke

4　　　　the corresponding one of said plurality of functions; and

5　　wherein the data in each of said metadata objects for locating the corresponding one of

6　　　　said plurality of functions identifies the corresponding one of said action units;

7　　　　and

8　　wherein each of said metadata objects includes an action method, which when applied,

9　　　　causes the execution of the instructions in the corresponding one of said action

10　　　　units.

1　18.　The machine readable medium of claim 17, wherein:

2　　each execution object includes a method, which when applied, causes said action method

3　　　　of the corresponding metadata object to be applied for that business rule;

4   each action method, when applied responsive to the method of an execution object,

5   causes the instructions in the corresponding action unit to be executed for that

6   business rule; and

7   the instructions in each action unit, when applied responsive to an action method

8   responsive to the method of an execution object, causes the values of that business

9   rule to be accessed and said function of that action unit to be invoked with said

10   values as input parameters.

1   19.   The machine readable medium of claim 15, wherein at least one of said execution objects

2   stores the key and a corresponding value for at least one input parameter of the corresponding

3   one of said plurality of functions.

1   20.   The machine readable medium of claim 15, wherein:

2   .   at least one of said execution objects includes a structure identifying a manager object;

3   and

4   said manager object includes a structure to store the key and a corresponding value for at

5   least on input parameter of the one of said plurality of functions corresponding to

6   the at least one of said execution objects.

1   21.   The machine readable medium of claim 15, wherein:

2   at least one of said execution objects includes a structure identifying a manager object;

3   and

4   said manager object includes,

5   a first structure to store a plurality of context objects, each of said plurality of

6   context objects to store the key and a corresponding value for one or more

7   input parameters to at least certain of the plurality of functions, and

8   a second structure to store data identifying one of said plurality of context objects

9   as a default context object.

1   22.   The machine readable medium of claim 15, wherein:

2   each of said plurality of functions provides one or more output parameters, the input and

3   output parameters of said plurality of functions collectively defining said set of

4   parameter kinds irrespective of data type;

5   each said metadata object also storing the unique key for each input and output parameter

6   of the corresponding one of said plurality of functions.

1 .23.   A machine readable medium having stored thereon sequences of instructions, which

2   when executed by a set of one or more processors, cause said set of one or more processors to

3   perform the acts of:

4   applying a first method from a first execution object, said first execution object

5   identifying a first metadata object corresponding to a first function, said first

6   function requiring one or more input parameters, said first metadata object storing

7   data describing each input parameter of said first function, said first method

8   causing the acts of,

9   accessing the data describing each input parameter of said first function from said

10   first metadata object;

11   attempting to match values associated with said first execution object to each

12   input parameter of said first function as described by the data; and

13   determining a value is missing for at least a first input parameter to said first

14   function.

1   24.   The machine readable medium of claim 23, wherein said first method further causes the

2   acts of:

3   locating a second metadata object corresponding to a second function having one or more

4   output parameters, said second metadata object storing data describing each

5   output parameter of said second function;

6   determining the missing first input parameter is an output parameter of said second

7   function; and

8   executing said second function to acquire the missing value.

1   25.   The machine readable medium of claim 24, wherein said first method further causes the

2   . act of:

3   associating the acquired value with said first execution object; and

4   executing said first function using the acquired value now associated with said first

5   execution object as the first input parameter.

1   26.   The machine readable medium of claim 23, wherein said first method further causes the

2   acts of:

3   determining a set of metadata objects that each have stored therein data describing an

4   output parameter that matches one or more of the missing input parameters,

5   wherein each metadata object in said set corresponds to a different function

6   having a set of one or more output parameters, each metadata object in said set

7	storing data describing said set of output parameters for the corresponding
8	function; and
9	executing the functions corresponding to the set of metadata objects to acquire said set of
10	missing values;
11	associating the acquired values with the first execution object; and
12	executing said first function using the values associated with the first execution object as
13	input parameters.

1 27. The machine readable medium of claim 23, wherein said attempting further includes:

2   accessing a structure in said first execution object, said structure in said first execution

3   object to store values for one or more said set of input parameters to said first

4   function.

1 .28. The machine readable medium of claim 23, wherein said attempting further includes:

2   accessing a structure in a manager object identified by a structure in said first execution

3   object, said structure in said manager object identifying a default one of a

4   plurality of context objects, each of said plurality of context objects to store

5   values for one or more of the input parameters to said first function; and

6   accessing said values from said default context object.

1 29. The machine readable medium of claim 23, wherein said sequences of instructions, when

2   executed, cause said set of processors to further perform the acts of:

3   applying a first method from a second execution object, said second execution object also

4   identifying said first metadata object, said first method of said second execution

5   object causing the acts of,

6	accessing the data describing each input parameter of said first function from said
7	first metadata object;
8	attempting to match values associated with said second execution object to each
9	input parameter of said first function as described by the data in said first
10	metadata object; and
11	determining one or more values are missing for at least certain input parameters
12	of said first function.

1	30.	A machine readable medium having stored thereon sequences of instructions, which
2	when executed by a set of one or more processors, cause said set of one or more processors to
3	perform the acts of:
4	applying a first method from a first execution object, said first execution object
5	identifying a first of a plurality of metadata objects, each of said plurality of
6	metadata objects identifying a different function, each of said functions having
7	input and output parameters, wherein one or more parameters for different
8	functions are the same, the parameters for the different functions collectively
9	defining a set of parameter kinds, each parameter kind in said set of parameter
10	kinds being assigned a unique key, each of said plurality of metadata objects
11	storing the unique keys assigned the input and output parameters of the function
12	they identify, said first method causing the acts of,
13	accessing the key for each input parameter stored in said first metadata object;
14	attempting to match parameter values associated with said first execution object
15	to each of the accessed keys; and
16	determining parameter values are missing for a set including at least one of the
17	accessed keys.

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1   31.   The machine readable medium of claim 30, wherein each parameter of said functions is

2   of one of a plurality of data types each supporting a range of values, wherein different data is

3   categorized irrespective of data type, and wherein each category of data defines one of the set of

4   parameter kinds.

1   32.   The machine readable medium of claim 30, wherein said first method further causes the

2   acts of:

3   locating a set of one or more of said plurality of metadata objects that collectively store

4   each of the set of keys; and

5   executing the functions corresponding to the set of metadata objects to acquire said set of

6   missing parameter values as outputs of the functions;

7   associating the acquired parameter values with the first execution object; and

8   executing the function identified by the first metadata object using the parameter values

9   associated with the first execution object as input parameters.

1   33.   The machine readable medium of claim 30, wherein said attempting further includes:

2   accessing a structure in said first execution object, said structure in said first execution

3   object to store values for one or more said set of input parameters to the function

4   identified by the first metadata object.

1   34.   The machine readable medium of claim 30, wherein said attempting further includes:

2   accessing a structure in a manager object identified by a structure in said first execution

3   object, said structure in said manager object identifying a default one of a

4   plurality of context objects, each of said plurality of context objects to store

5   values for one or more of the input parameters to said first function; and

6   accessing one or more of said values from said default context object.

1   35.   The machine readable medium of claim 30, wherein said sequences of instructions, when

2   executed, cause said set of processors to further perform the acts of:

3   applying a first method from a second execution object, said second execution object also

4   identifying said first metadata object, said first method of said second execution

5   object causing the acts of,

6   accessing the key for each input parameter stored in said first metadata object;

7   attempting to match values associated with said second execution object to each

8   of the accessed keys; and

9   determining parameter values are missing for a set including at least one of the

10   accessed keys.

1   36.   The machine readable medium of claim 30, wherein said attempting further includes:

2   accessing from a first structure in said first execution object a value for a first input

3   parameter to said function identified by said first metadata object;

4   accessing, from a first of a set of context objects that was passed, a value for a second

5   input parameter to said first function, said set of context objects being stored in a

6   first structure of a manager object, each of said set of context objects to store

7   values for one or more of the input parameters to said first function, said manager

8   object identifying one of said set of context objects as a default context object;

9   and

10   accessing from said default context object a value for a third input parameter to said first

11   function.

1   37.   A machine readable medium having stored thereon sequences of instructions, which

2   when executed by a set of one or more processors, cause said set of one or more processors to

3   perform the acts of:

4   receiving a request to locate a function that provides a particular parameter kind as an

5   output;

6   locating a metadata object having stored therein data identifying said particular parameter

7   kind, said metadata object identifying a function and storing said data to indicate

8   the particular parameter kind is an output parameter of said function; and

9   providing an execution object that identifies said metadata object, wherein said execution

10   object includes,

11   a structure to identify values for a set of one or more input parameters to said

12   function, and

13   a method, which when applied, causes said function to be invoked using the

14   values identified by said structure as input parameters.

1   38.   The machine readable medium of claim 37, wherein:

2   said function has a plurality of parameters, said metadata object stores data identifying

3   each kind of said plurality of parameters.

1   39.   The machine readable medium of claim 38, wherein each parameter of said function is of

2   one of a plurality of data types each supporting a range of values, wherein different data is

3   categorized irrespective of data type, and wherein each category of data defines one of the

4   parameter kinds.

1   40.   The machine readable medium of claim 37, wherein:

2   said metadata object includes an action method, which when applied by a processor,

3   causes said processor to invoke said function; and

4   said method in said execution object, when applied, causes said action method to be

5   applied.

1   41.   A machine readable medium having stored thereon sequences of instructions, which

2   when executed by a set of one or more processors, cause said set of one or more processors to

3   perform the acts of:

4   receiving a request to locate a function that provides a particular output parameter,

5   wherein each of a plurality of metadata objects identify a different function

6   having one or more output parameters, said output parameters for the different

7   functions collectively defining a set of parameter kinds, each parameter kind in

8   said set being assigned a unique key, each of said plurality of metadata objects

9   storing the unique keys assigned the output parameters of the function they

10   identify;

11   locating a first of said plurality of metadata objects that stores the unique key for the

12   particular output parameter; and

13   creating an execution object that identifies said first metadata object, wherein said

14   execution object includes,

15   a structure to identify values for a set of one or more input parameters to said

16   function identified by said first metadata object, and

17   a method, which when applied, causes said function identified by said first

18   metadata object to be invoked using the values identified by said structure

19   as input parameters.

1   42.   The machine readable medium of claim 41, wherein each parameter of said functions is

2   of one of a plurality of data types each supporting a range of values, wherein different data is

3   categorized irrespective of data type, and wherein each category of data defines one of the

4   parameter kinds.

1   43.   The machine readable medium of claim 41, wherein said sequences of instructions, when

2   executed, cause said set of processors to further perform the acts of:

3   applying said method from said execution object, wherein both said input and output

4   parameters for the different functions collectively define said set of parameter

5   kinds, each of said plurality of metadata objects storing the unique keys assigned

6   the input and output parameters of the function they identify, said method from

7   said execution object causing the acts of,

8   accessing the key for each input parameter stored in said first metadata object;

9   attempting to match parameter values associated with said execution object to

10   each of the accessed keys; and

11   executing the function identified by said first metadata object using the parameter

12   values associated with the execution object as input parameters.

1   44.   The machine readable medium of claim 41, wherein said attempting further causes the

2   acts of:

3   determining parameter values are missing for a set including at least one of the accessed

4   keys.

5   locating a set of one or more of said plurality of metadata objects that collectively store

6   each of the set of keys for output parameters; and

7   executing the functions corresponding to the plurality of metadata objects to acquire said

8   set of missing parameter values as outputs of the functions; and

9   associating the acquired parameter values with first execution object.

1   45.   A machine readable medium having stored thereon sequences of instructions, which

2   when executed by a set of one or more processors, cause said set of one or more processors to

3   perform the acts of:

4   applying a first method from a first execution object, said first execution object

5   identifying a first of a plurality of metadata objects, each of said plurality of

6   metadata objects identifying a different function, each of said functions having

7   input and output parameters, wherein one or more parameters for different

8   functions are the same, said parameters for the different functions collectively

9   defining a set of parameter kinds, each parameter kind in said set of parameter

10   kinds being assigned a unique key, each of said plurality of metadata objects

11   storing the unique keys assigned the input and output parameters of the function

12   they identify, said first method causing the acts of,

13   accessing the key for each input parameter stored in said first metadata object;

14   associating with said first execution object a value stored as part of a first of a set

15   of context objects that was passed, said value stored for use as a first input

16   parameter, said set of context objects being stored in a first structure of a

17   manager object, each of said set of context objects to store values for one

18   or more of the input parameters to said first function; and

19   executing said first function using the parameter values associated with the first

20   execution object as input parameters.

1 46. The machine readable medium of claim 45, wherein said first method further causes the

2 acts of:

3   associating with said first execution object a value stored as part of one of said set of

4   context objects identified by said manager object as a default context object, said

5   value stored for a second input parameter to said first function.

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